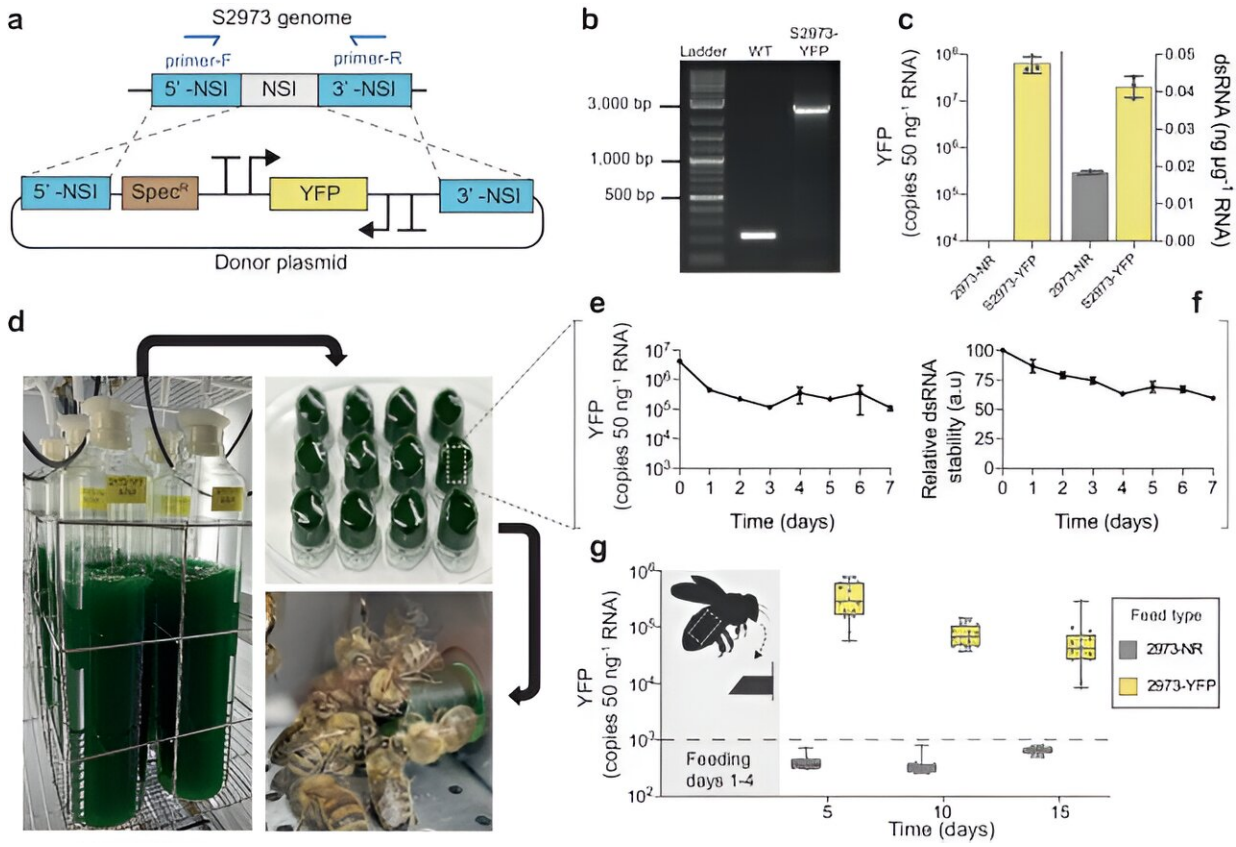
Researchers use an edible blue-green algae to protect honey bees against viruses

March 19 2024



Engineering S2973 for in-feed delivery of dsRNA. a Integration of dsRNA expression cassettes into the S2973 genome. Cassettes produce target dsRNA with an inverted arrangement of two promoters and are flanked by sequences for homologous recombination at neutral site I (NSI). Primers used for PCR

genotyping are noted. b Segregation analysis of a YFP dsRNA expression cassette. Wild type (WT) strain had a PCR product of 234 bp and no WT copy was present in strain S2973-YFP. c dsRNA production. Vector control strain S2973-NR did not express YFP RNA. dsRNA accumulation by S2973-YFP was twice that of endogenous background levels as measured by dsRNA ELISA. d Biomass production and feed formulation. Fresh S2973 biomass was mixed into a pollen-sugar paste for feeding bees. e YFP RNA stability and f relative dsRNA stability in formulated feeding treatments under colony conditions (34 °C and 50% relative humidity). g Detection of YFP RNA in bees fed S2973 diets and then sampled over time. Bee abdomens with guts intact were used for this analysis. YFP RNA was detected in bees fed S2973-YFP for at least 11 days after their last feeding (n = 16). Credit: *npj Sustainable Agriculture* (2024). DOI: 10.1038/s44264-024-00011-7

Scientists at the United States Department of Agriculture (USDA)'s Agricultural Research Service (ARS) have developed an edible antiviral treatment that can be used to protect honey bees against deformed wing virus (DWV) and other viruses, according to a recent study published in *npj Sustainable Agriculture*.

Honey bees are important agricultural pollinators. However, viruses, including DWV, are linked to the deaths of millions of colonies worldwide. DWV, like other viruses, is most often spread by Varroa mites who carry the disease inside them and infect bee colonies. Infection typically causes deformity and death in bees, especially in the pupae and brood. These colony losses devastate beekeeping industries and pose a major risk to agriculture and the global food supply.

While there are medicines for other bee diseases and parasites, there is currently no treatment available to help beekeepers reduce viruses in

their colonies. Nearly all colonies have DWV and can often be infected with multiple viruses at any given time. Effective antiviral treatments could help to improve colony health and survival as well as crop pollination efficiency.

"We found that engineered algae diets suppressed DWV infection and improved survival in honey bees," said Vincent Ricigliano, research scientist at the ARS Honey Bee Laboratory in Baton Rouge, Louisiana. "When mixed into bee food, the engineered algae boost the bee's immune system to fight off the targeted virus."

According to Ricigliano, blue-green algae is the "bee's knees" of bee food additives. Ricigliano and other ARS researchers previously studied blue-green microscopic algae, also known as microalgae, as a potential food source for honey bees. The algae showed promise since it has a nutritional profile that resembles pollen and is scalable to the level of commercial beekeeping.

"In addition to the nutritional benefits and immune-boosting effects, engineered algae strains have the potential to protect bees against a wide variety of pathogens," said Ricigliano.

Blue-green algae grow via photosynthesis and can remove carbon dioxide from the atmosphere, making it an ecologically friendly approach to improve the health of honey bees.

"This technology represents a potential new class of treatments for honey bees that is highly sustainable and scalable," said Ricigliano. "It can be added directly to supplemental feed without additional processing and easily integrated into beekeepers' existing management practices. However, there are regulatory considerations that must be addressed before these applications can be fully realized."

The researchers have filed a patent application for the technology and plan to use variations of it to target additional bee viruses and other pathogens in future studies.

More information: Vincent A. Ricigliano et al, Green biomanufacturing of edible antiviral therapeutics for managed pollinators, *npj Sustainable Agriculture* (2024). DOI: 10.1038/s44264-024-00011-7

Provided by Agricultural Research Service